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G4H

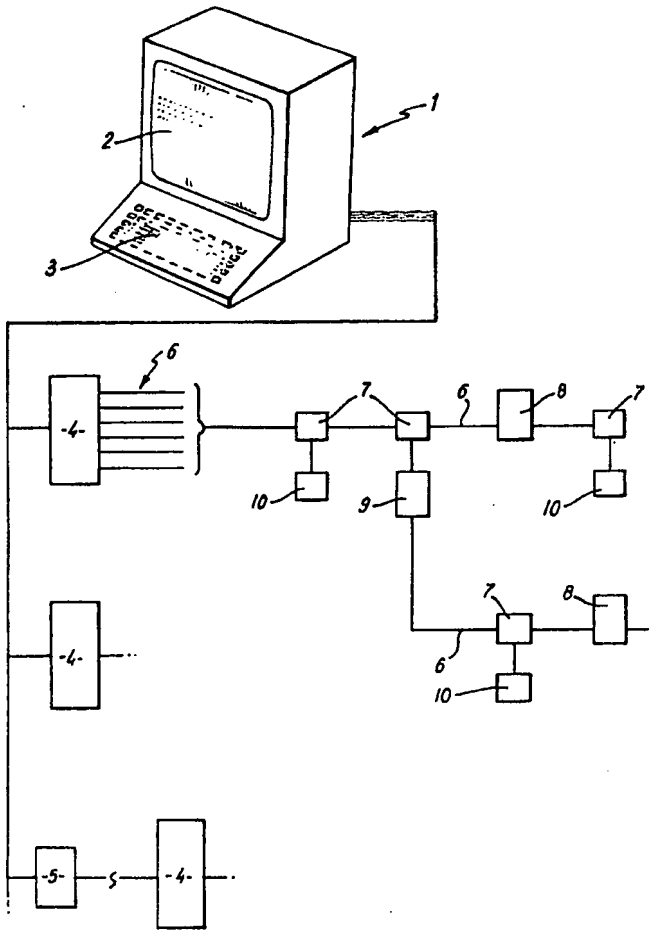
(71) Applicant
Software Control Limited (United Kingdom),
Wharton Building, Station Road, Reddish, Stockport, Greater Manchester SK5 6LT

(72) Inventors
John Jones
Philip Hall Bertenshaw

(74) Agent and/or Address for Service
M'Caw & Co,
41–51 Royal Exchange, Cross Street, Manchester M2 7BD

(54) Computer control system

(57) Diferent items of electrical equipment (10) can be controlled from a common remote computer (1) by signals transmitted along a multi-lead bus cable (6). At one end the cable (6) is linked to a line unit (4) and at its other end it is linked to a series of addressable control devices (7) connected to the equipment (10). The transmitted signals include address signals which identify the addressable device (7) which is to be actuated, and data signals which control operation of the equipment (10) connected to the actuated addressable device.



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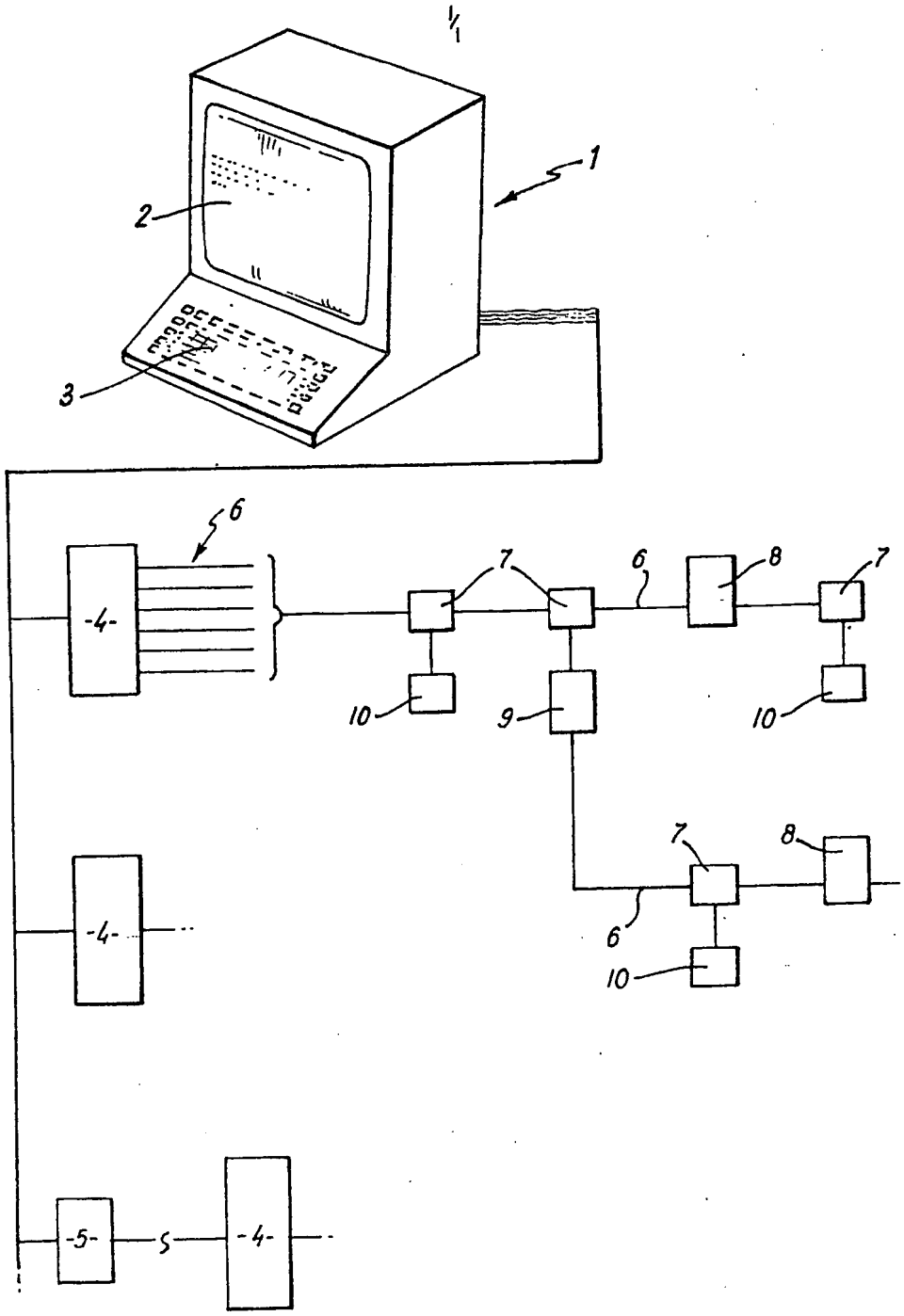
The drawing originally filed was informal and the print here reproduced is taken from a later filed formal copy.
The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.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SPECIFICATION

Computer control system

This invention relates to a computer control system for use in the remote monitoring and/or operation of equipment.

Small computers, particularly "desk top" microcomputers are now widely available and can be used for equipment control purposes. Known microcomputer-based equipment control systems involve the connection of electrical leads to the computer via an interface so that actuating current can be supplied along the leads to a remote electrically-operated device under the control of the computer. However, with such known systems the problem arises that diverse and versatile equipment control over relatively large distances may be difficult to achieve satisfactorily without using expensive and complicated wiring arrangements.

An object of the present invention is to overcome or at least appreciably reduce this problem.

According to the invention therefore there is provided a computer control system for use in the remote control of equipment wherein said equipment is connected to a computer via a remote link, characterised in that said link comprises a multi-lead cable between an interface local to the computer and an addressable device operatively connected to said equipment whereby control of said equipment can be effected by said computer by transmission along said cable of address signals pertaining to the identity of said device and of data signals pertaining to the operation of said equipment.

With this arrangement remote control in the sense of collecting data from and/or effecting operation of, said equipment can be performed conveniently and satisfactorily without requiring expensive and complicated wiring in so far as the main link between the computer and the equipment is not required to carry operating power for the equipment. Moreover, great versatility can be readily achieved in so far as it is convenient for example to utilise multiple said devices (with a single or multiple said interfaces) which can be selectively, independently addressed, and/or to accommodate a range of data signals in either or both directions and/or to use different cable configurations such as multiple or branched runs or the like.

With regard to the computer, any suitable kind may be used although it is visualised that the invention will be especially advantageous in the context of a computer of the desk top microcomputer kind.

In particular, the computer may be of the proprietary kind having, preferably as a unit, an alphanumeric keyboard and a vdu screen, internal processing and memory capability, and i/o ports for connection to peripheral hardware such as a printer and a disc drive. Moreover, the arrangement is preferably such that control of the said equipment by the computer can be effected after programming the computer in the usual manner using software written in machine code or a high level language such as basic or pascal or the like such that initiation of transmission of said address and data signals along said multi-lead cable for control purposes is effected automatically and/or in response to operator instructions entered via the keyboard as determined by the software program.

Said interface between the multi-lead cable and the computer may be incorporated in the computer or alternatively may be a separate device linked thereto for example via the usual i/o port or ports provided for a printer, disc drive or other peripheral. The interface may comprise circuitry which acts to translate ASCII string commands from the computer to information signals (of an asynchronous or synchronous nature) on the cable and vice versa. The circuitry may include a processing unit and programmed memory device (e.g. an EPROM). If desired, the interface may also include one or more of: a power supply to feed power to leads of the cable (where this is required); capacity for storing and implementing auxiliary programs; supplementary facilities for special applications (e.g. a clock-calendar facility etc.); and a battery back-up power source.

The said addressable device may take any suitable form and, where appropriate, may be powered from supply leads of the bus or otherwise as desired. The operation of the device may be such that in response to a command derived from the computer an "echo" is transmitted back from the device giving address and status information for verification and information purposes.

The said addressable device may incorporate a power switching relay or other component for interface with the equipment to be controlled.

The system of the invention may be used to control any suitable kind of equipment in any suitable manner. Thus the system may be used to effect switching or adjustment of heavy duty electrical loads such as electrical motors, heaters, lamps and the like, or for remote switching or adjustment of lighter loads such as message panels, display devices, analogue or switched monitoring points, floating output voltage references, other computer systems of the same or different kind, or for any other suitable purpose. The arrangement may be such that the system controls flow of actuating current to electrical equipment and/or controls flow of information from a sensor or monitoring device back to the computer.

The system of the invention may find appli-

cation in the context of energy management, environmental control, security and fire systems, data collection and distribution, plant control, machine operation etc.

The system is particularly suitable for complex control of multiple equipment functions at widely distributed positions in so far as it is possible to install the requisite configurations of interconnecting cables easily and inexpensively even over relatively large distances (say of the order of several kilometres).

The invention will now be described further by way of example only and with reference to the accompanying drawing which is a schematic representation of one form of a computer control system according to the invention.

The system shown in the drawing may be used for controlling the operation of multiple pieces of electrical equipment in an establishment, e.g. plant equipment in a factory or environmental (heating/ventilating) equipment in a building.

The system utilises a desk top microcomputer 1 at a convenient central location, such computer having in one unit, a vdu screen 2 and a keyboard 3 and containing a central processor, memory capability, interface devices, a power supply, and the like, in conventional manner. The computer has at least two 8-bit bidirectional i/o ports such as the usual printer and disc drive sockets which in use handle ASCII string commands.

A number of local intelligent line units 4 (up to 8) are connected to the computer via two i/o ports, such units 4 being conveniently mounted in a common housing and provided with a suitable plug or connector at the end of a multi-lead 'ribbon' conductor for engagement with the i/o sockets. Alternatively or additionally, one or more such units 4 may be remotely linked to the computer port via a telephone line and modem 5.

Each unit is an 'intelligent' peripheral comprising a software controlled programmable module with power supply, a peak power demand metering system (for energy management applications), a digital clock-calendar giving day of week, month and date, battery back-up, spare memory capacity for customised machine code programs. The unit is preprogrammed (e.g. in EPROM) in accordance with the system requirements.

Each unit 4 is connected to a six-lead bus cable 6 which may be of several kilometres length and is linked to remote control points 7 (up to 1024). The bus leads 6 comprise respectively: + 12 volts d.c. supply line, ground, address bus 1, address bus 2, downstream data bus, upstream data bus.

As indicated in the drawing, power supply boosters 8 may be provided at intervals in the cable 6. Also, opto-isolators (not shown) may be interposed at appropriate positions, e.g. between the computer and each unit 4, and before each booster 8 to prevent electrical damage. The wiring arrangement is divided into a number of 'blocks' separated by the boosters 8 (each of which blocks may correspond to a cable length of about 0.5 km) and also one or more legs or branches tapped off from the main cable run at a control point 7 via a local intelligent controller 9.

Each said control point 7 comprises an addressable electronic device which is powered from the supply and ground lines of the cable 6. The device is operable to monitor address data transmitted from the pertaining unit down the address buses. Each device has a unique address identity and when this is detected on the address buses, the same address data and also operational status data is fed back to the unit 4 on the upstream data bus using asynchronous binary information or frequency- or pulse width-modulated data.

The addressable device 7 is capable of operating a device connected thereto in response to command instructions received via the downstream data bus after the device 7 has been properly addressed. This further device may be of the form of an on-off switch 10 which is used to switch a load on and off (via a relay), or which is operable to connect a remote control unit to the downstream data line to receive information therefrom or to the upstream data line to relay locally collected information thereto. In the latter respect the local unit may implement a frequency or pulse width to voltage conversion or vice versa. Where conversion to a voltage is used (when data is supplied to the local unit) the information may be latched to give a static output.

In other cases, where a remote local intelligent controller 9 is connected to a respective control point 7, such controller may incorporate microprocessor based circuitry and may be operable when appropriately addressed and operated to relay address and data information between the pertaining unit 4 and the associated cable branch linked to such controller 9.

Each control point 7 may incorporate a local override facility (e.g. a key switch), a switch selectable address facility and a switch selectable data transfer baud rate facility.

With the arrangement so far described multiple pieces of equipment can be controlled from the computer in the sense of effecting operation of equipment (e.g. switching on and off circulation pump motors and fan motors of an environmental control system) and in the sense of monitoring parameters (e.g. receiving status data indicating correct operation of motors etc., and receiving data derived from measurement and monitoring devices (such as thermostats etc.).

This control can be achieved easily and conveniently for example by entering commands via the keyboard 3 which may be straightforward alphanumeric commands (e.g.

"switch-on pump 3") as determined by the nature of the software. Moreover, it is possible to allow for easy fault tracing in that, for example, the computer may display messages such as "fault in pump No. 3". It is even possible to allow for a dialogue whereby for example the operator can enter requests such as "status of pump No. 3".

Advantageously, a large number of control points can be accommodated with a wiring arrangement which can be installed easily and relatively inexpensively in so far as it utilises normal signal cable.

It is of course to be understood that the invention is not intended to be restricted to the details of the above embodiment which are described by way of example only.

CLAIMS

1. A computer control system for use in the remote control of equipment wherein said equipment is connected to a computer via a remote link, characterised in that said link comprises a multi-lead cable between an interface local to the computer and an addressable device operatively connected to said equipment whereby control of said equipment can be effected by said computer by transmission along said cable of address signals pertaining to the identity of said device and of data signals pertaining to the operation of said equipment.

2. A system according to claim 1, wherein there are multiple said devices which can be selectively, independently addressed via the same said cable.

3. A system according to claim 2, wherein said cable has branches thereto.

4. A system according to any one of claims 1 to 3, wherein there are multiple said interfaces each with a respective said cable.

5. A system according to any one of claims 1 to 4, wherein said interface includes programmed processing circuitry.

6. A system according to any one of claims 1 to 5, wherein said addressable device is arranged to transmit signals back to the computer, in response to a command therefrom, giving address and status information for verification and information purposes.

7. A system according to any one of claims 1 to 6, wherein said cable carries electrical power as well as said signals.

8. A system according to claim 7, wherein a power supply booster is provided in said cable.

9. A system according to any one of claims 1 to 8, wherein said cable has six leads namely a power supply line, ground, two address buses, a downstream data bus and an upstream data bus.

10. A system substantially as hereinbefore described with reference to and as illustrated in the drawings.

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